

## THE LIFE HISTORY OF *CANDALIDES INSANEA* MÜLLER, 2013 (LEPIDOPTERA: LYCAENIDAE) AND DESCRIPTION OF THE FEMALE

CHRIS J. MÜLLER

Honorary Associate, Australian Museum, 6 College Street, Sydney, NSW 2010. (Address for correspondence: PO Box 3228, Dural, NSW 2158; Email: chrismuller999@gmail.com)

### Abstract

The early stages and adult female of *Candalides insanea* Müller, from the Bismarck Archipelago, Papua New Guinea, are described and figured. *Corandrium polyanthem* (Laut. & K.Sch.) Mez. (Primulaceae) is tentatively recorded as the larval food plant.

### Introduction

*Candalides insanea* Müller, 2013, previously known only from the male holotype, is a recently described species that appears to be endemic to the island of New Britain, Papua New Guinea. Currently, the species is only known from the Whiteman Range, West New Britain Province, where other distinctive butterfly taxa have been discovered in recent times (Müller and Wills 2013, Müller 2014a). It is the only species of *Candalides* Hübner known to occur in the Bismarck Archipelago.

Müller (2013) placed *C. insanea* in the ‘*absimilis* group’ of *Candalides*, formerly within *Holochila* Felder, recognised by Tite (1963) and Braby (2000). This is the largest species-group of the genus, with representatives in mainland New Guinea and satellite islands and with four species in northern and eastern Australia (Parsons 1998, Braby 2000, 2008). Members of the *absimilis* group appear to fall into two further divisions, in which one has male genitalia with relatively simple valva, while the other has valvae which bear long apical appendages (Müller 2014b).

Müller (2013) considered that *C. insanea* has no close relatives, based on its distinctive facies, but compared the taxon with *C. pruina* Druce, 1904, *C. neurapacuna* Bethune-Baker, 1908 and *C. silicea* (Grose-Smith, 1894) (see also Müller 2014b), all of which possess long apical processes to the valva of the male genitalia. The male genitalia of *C. insanea* are particularly large and the valvae are adorned with exaggerated, blade-like processes.

*C. insanea* is an exquisite species with a unique iridescent green upperside and broad, straight forewing border that is oblique to the termen. The taxon has long forewings, giving it a distinctive shape. It has the most boldly patterned underside in the genus and the underside ground colour is also atypical of the genus, being light grey with a slight pink hue.

Voucher specimens, all collected within 5 km of the type locality at 6°0'S 150°35'E, between November 2011 and December 2014, have been deposited in the Australian Museum (Sydney), Australian National Insect Collection (Canberra), Natural History Museum (London) and in the reference collections of the author and that of Ed Petrie.

### *Candalides insanea* Müller

(Figs 1-4)

*Description of female* (Figs 3-4). Measurements (mm): forewing length mean 20 (n = 20); antenna length mean 12 (n = 20). Head dark brown-black; labial palpus light white-grey, eye ringed narrowly with white-grey; antennae black, ringed weakly with grey ventrally. Thorax dark grey-brown above, beneath white-grey. Abdomen dark brown-black above, white-grey beneath.

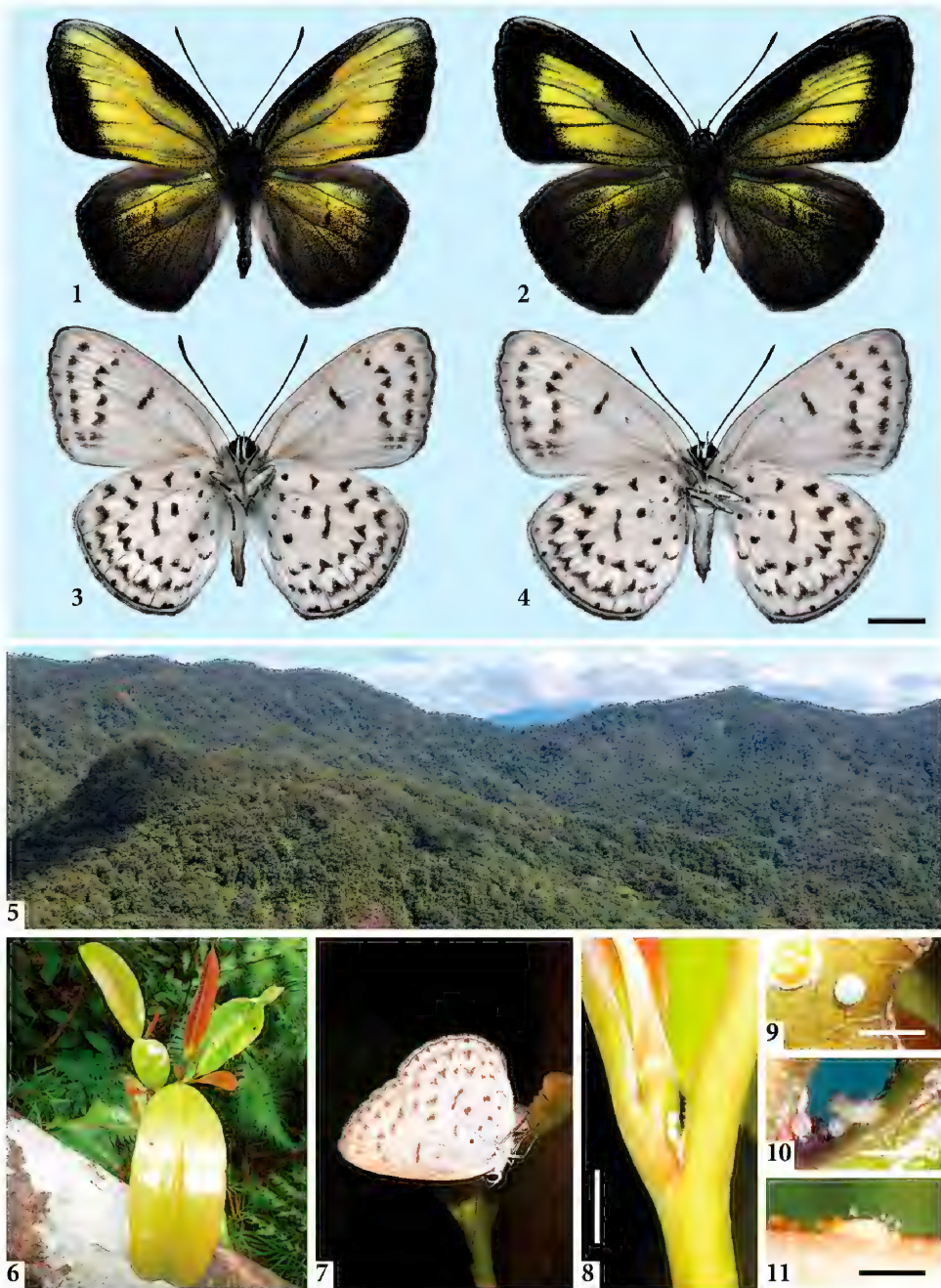
Forewing with termen slightly convex, subtly serrated near apex; upperside ground colour iridescent bronze-green, black along veins; costa and termen broadly dark brown-black, extending narrowly into cell, costa near apex narrowly grey-pink, cilia brown-black and white-grey at tornus and along inner margin; underside background colour white-grey with subtle pink hue, termen narrowly black, a row of diffuse black terminal spots (*ca* 1 mm in size) between veins, a second row of subterminal spots of similar size and colouring between veins 1b and 7 that are more clearly defined towards termen, a postmedian band of triangular dark brown-black spots (*ca* 1 mm in size but decreasing in size towards costa) between veins 1b and 9, offset at vein 4, the postmedian and subterminal bands converge between veins 1b and 2, a median black bar in discocellular region at end of cell between veins 4 and 6, cilia light grey and dark grey at vein ends.

Hind wing rounded; upperside ground colour bronze-green, heavily dusted with dark brown, also dark brown along veins and discocellulars, costa, termen and inner margin broadly dark brown, between inner margin and vein 1b medium brown grading to light grey at base, cilia dark brown-black close to termen and light grey elsewhere; underside background colour white-grey with subtle pink hue, termen narrowly black, a row of well-defined black terminal spots (approximately 0.7 mm in size) between veins from vein 1b to 7, a second row of triangular subterminal spots (up to 1.5 mm in size) of similar colouring between veins 2 and 8, a postmedian band of triangular black spots approximately 1 mm in size between veins 2 and 8, a sub-basal row of four irregular dark brown-black spots approximately 0.7 mm in size, a basal row of four well defined circular black spots approximately 0.5 mm in size, a median dark brown-black bar approximately 0.3 mm wide in discocellular region at end of cell between veins 4 and 6, cilia light grey and dark grey at vein ends.

#### *Early stages*

*Food plant.* *Conandrium polyanthum* (Laut. & K.Sch.) Mez. (Primulaceae). The plant (Fig. 6) has been tentatively identified owing to the absence of inflorescence material for the assessment.

*Egg* (Figs 8-9). Approximately 1.0 mm in diameter, 0.5 mm high; intricately pitted; white (pale blue-green when first laid). Duration four to five days.



**Figs 1-11.** (1-4) *Candalides insanea* adults: (1) male upperside; (2) female upperside; (3) male underside; (4) female underside. (5) Typical habitat of *C. insanea*, Whiteman Range. (6) *C. insanea* larval food plant. (7) *C. insanea* female ovipositing. (8) *C. insanea* eggs. (9) *C. insanea* egg. (10) *C. insanea* first instar larva emerging. (11) *C. insanea* first instar larva feeding. Scale bar = 5 mm (Figs 1-4, 8); 2 mm (Figs 9-11).

*First instar larva* (Figs 10-11). 1.5-2.0 mm long, 0.5 mm wide; head light orange-brown; body pale green, with narrow pink dorsal stripe; series of long dorsolateral and ventrolateral translucent setae arranged in pairs.

*Second instar larva* (Figs 12-13). 2.5-3.5 mm long, 1.0 mm wide; head light orange-brown; abdominal segment 12 protruding laterally; body light yellow-orange, with orange dorsal stripe and adjacent pale yellow dorsolateral lines; anal plate grey, grading to pink posteriorly; a series of light brown dorsolateral setae; series of translucent ventrolateral setae.

*Third instar larva* (Figs 14-15). 9-10 mm long, 4 mm wide; head light orange-brown; abdominal segment 12 protruding laterally; body pale pink with deeper pink narrow dorsal stripe widest at segments 5 and 10; abdominal segments 11-13 flattened, apple green rimmed with pink; coarse short brown dorsal setae.

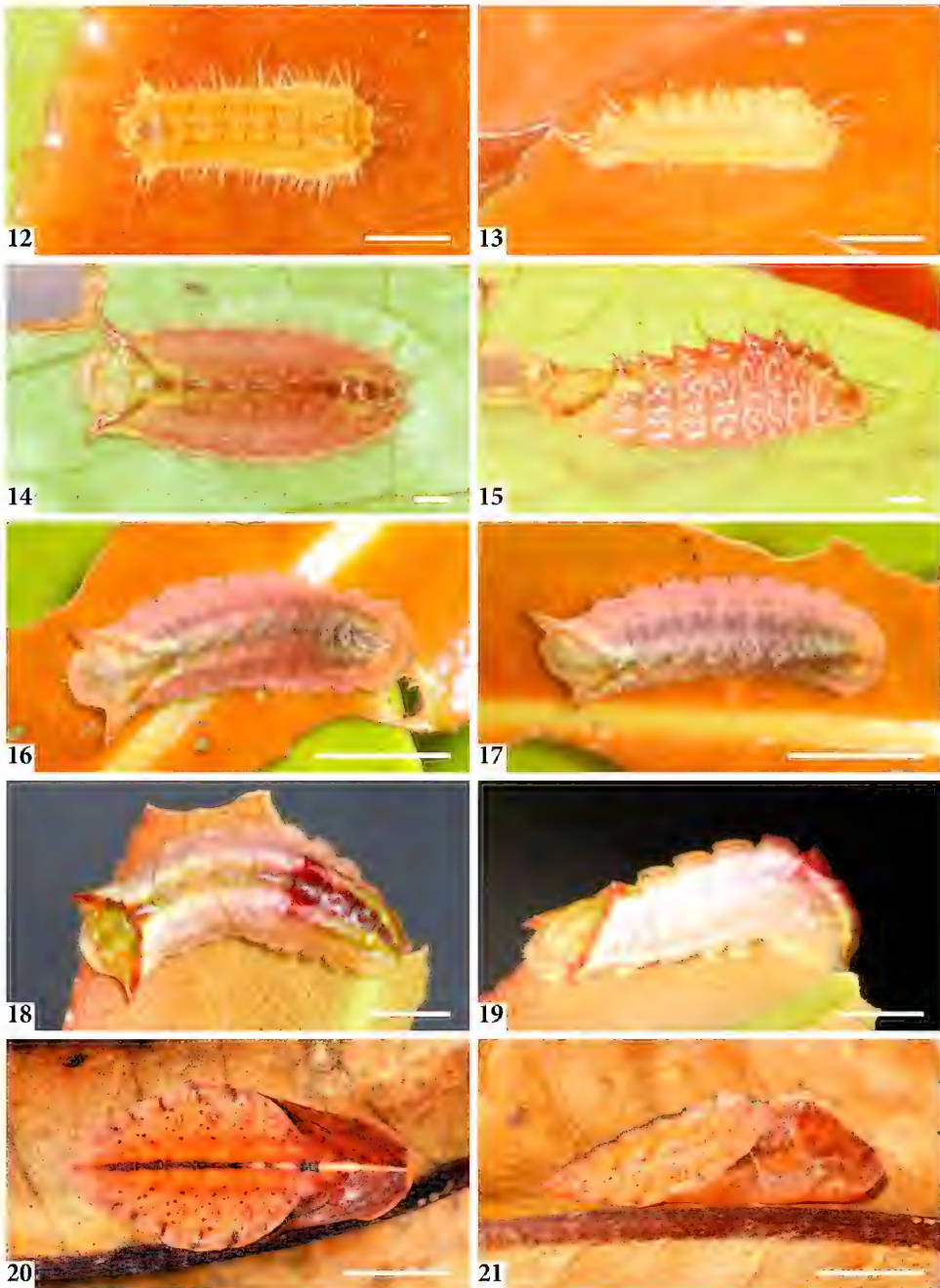
*Fourth instar larva* (Figs 16-17). 14-15 mm long, 5 mm wide; head light brown; abdominal segment 12 protruding laterally; body pale pink with deeper pink dorsolateral stripes and apple green dorsal stripe; abdominal segments 11-13 flattened, grey-green rimmed with pink; short sharp dorsal brown spines, angled posteriorly.

*Fifth instar larva* (Figs 18-19). 19-20 mm long, 6-7 mm wide; head light brown; abdominal segment 12 protruding laterally; body pale pink with deeper pink lateral stripe and conspicuous dorsal stripe that is apple green in segments 7-9 and crimson in segments 1-6, forming broad crimson saddle in segment 5; abdominal segments 11-13 flattened, apple green rimmed with deep pink; short sharp dorsal spine in segment 5, sharp dorsal ridges in segments 6-10. Total larval duration 19-22 days.

*Pupa* (Figs 20-21). 15-16 mm long, 7-8 mm wide; anterior flanged, with median indentation dorsally; abdominal segments strongly flanged; mesothorax with prominent dorsal ridge; abdominal segments dorsally ridged, indented between segments; orange-fawn, faintly speckled with brown, narrow white dorsal stripe on head and mesothorax, narrow dark brown dorsal stripe on abdominal segments; spiracles and between abdominal segments brown; wing cases rimmed with dark brown dorsolaterally. Attached by cremaster and silken girdle between segments. Pupal duration 13-15 days.

## Discussion

*Candalides insanea* appears to be the largest species in the genus, with specimens of both sexes attaining forewing lengths of up to 21 mm. Both sexes are quite similar in phenotype, unlike other members of the genus, thereby suggesting the possibility of representing an early lineage within the *absimilis* species group. Only minor variation is noted in a long series of both sexes, with some females having slightly more extensive green scaling extending into the apical area of the forewing upperside than that figured.



**Figs 12-21.** *Candalides insanae* early stages: (12-13) second instar larva: (12) dorsal view; (13) lateral view. (14-15) third instar larva: (14) dorsal view; (15) lateral view. (16-17) fourth instar larva: (16) dorsal view; (17) lateral view. (18-19) fifth instar larva: (18) dorsal view; (19) lateral view. (20-21) pupa: (20) dorsal view; (21) lateral view. Scale bar = 1 mm (Figs 12-15); 5 mm (Figs 16-21).

Regular surveying in the Whiteman Range (Fig. 5), at a range of altitudes over a three year period, recorded only a limited number of *C. insanaea* adults. Where observed, both sexes flew high and directly and seldom settled. All specimens flew over ridge tops between 1000 and 1200 m during mid-morning to early afternoon when the sun was brightest. The Whiteman Range is renowned as one of the wettest parts of Papua New Guinea and often experiences weeks, sometimes months, of relentless heavy rain and strong winds with no sunshine, particularly during the winter months. At the elevations where *C. insanaea* occurs, temperatures during this period usually sit around 15°C during the day and night. Adults of *C. insanaea* have been recorded flying from the beginning of October to the end of May.

Females of *C. insanaea* oviposit early in the afternoon and eggs are deposited on or near new growth of the food plant (Fig. 7), either singly or in pairs (Fig. 8). Females usually lay one or two eggs and then disappear on long-ranging flights before returning briefly to continue ovipositing. Eggs are most commonly deposited at the base of leaf stems but are sometimes placed on branches, on the undersides of leaves or on debris trapped among the foliage. Upon hatching, first instar larvae migrate to the fresh tips of the new growth and begin feeding, creating narrow troughs within which they are well disguised. Larvae feed throughout the day and night on new growth of the food plant, sheltering on the undersides of mature leaves during ecdysis. The larvae are capable of moving very quickly and move easily between flushes of new growth on different widely spaced branches. Larvae of *C. insanaea* were never seen to be attended by ants. Upon maturity, larvae turn wholly purple-pink and wander for at least 24 hours in search of a pupation site. In captivity, when sleeved on branches of the larval food plant, the larvae invariably selected curled dead leaves provided in which to pupate. Adults often emerge in the evening, just prior to sunset. However, adults will also emerge during the day, from 1000h.

### Acknowledgement

Dr Wayne Takeuchi, Harvard University and Forest Research Institute, Lae, kindly provided the food plant identification.

### References

- BRABY, M.F. 2000. *Butterflies of Australia: their identification, biology and distribution*. CSIRO Publishing, Collingwood; xx + 976 pp.
- BRABY, M.F. 2008. Taxonomic review of *Candalides absimilis* (C. Felder, 1862) and *C. margarita* (Semper, 1879) (Lepidoptera: Lycaenidae), with descriptions of two new subspecies. *The Beagle, Records of the Museums and Art Galleries of the Northern Territory* 24: 33-54.
- MÜLLER, C.J. 2013. A remarkable new species of *Candalides* Hübner, 1819 (Lepidoptera, Lycaenidae) from the Bismarck Archipelago, Papua New Guinea. *Nachrichten Entomologischen Vereins Apollo* 34(1/2): 69-72.
- MÜLLER, C.J. 2014a. Six new species of *Philiris* Röber, 1891 (Lepidoptera, Lycaenidae) from Papua New Guinea. *ZooKeys* 395: 33-55. doi: 10.3897/zookeys.395.7110.

MÜLLER, C.J. 2014b. Correction to the identity of *Candalides biaka* (Tite, 1963) (Lepidoptera: Lycaenidae) in Müller (2013) publication. *Nachrichten Entomologischen Vereins Apollo* **35**(4): 207-208.

MÜLLER, C.J. and WILLS, L. 2013. The *Delias* Hübner, 1819 of the Bismarck Archipelago, Papua New Guinea, with description of a new species from New Britain Island (Lepidoptera, Pieridae). *Nachrichten des Entomologischen Vereins Apollo* **34**(1/2): 17-26.

PARSONS, M.J. 1998. *The butterflies of Papua New Guinea. Their systematics and biology*. Academic Press, London; xvi + 736 pp, xxvi + 136 pls.

TITE, G.E. 1963. A revision of the genus *Candalides* and allied genera (Lepidoptera: Lycaenidae). *Bulletin of the British Museum of Natural History (Entomology)* **14**: 197-259.